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**(71) Applicant(s)**

Horstmann Timers & Controls Limited

(Incorporated in the United Kingdom)

**Newbridge Road, BATH, Avon, BA1 3EF,  
United Kingdom**

**(72) Inventor(s)**

Entered (S) **David John Martin**

**(74) Agent and/or Address for Service**

Withers & Rogers

**4 Dyer's Buildings, Holborn, LONDON, EC1N 2JT,  
United Kingdom**

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**(56) Documents Cited**

**GB 2033177 A** **GB 2023952 A** **GB 1517176 A**  
**GB 1261995 A** **US 4905115 A** **US 4418374 A**  
**US 4412267 A** **US 4331996 A** **US 4183071 A**

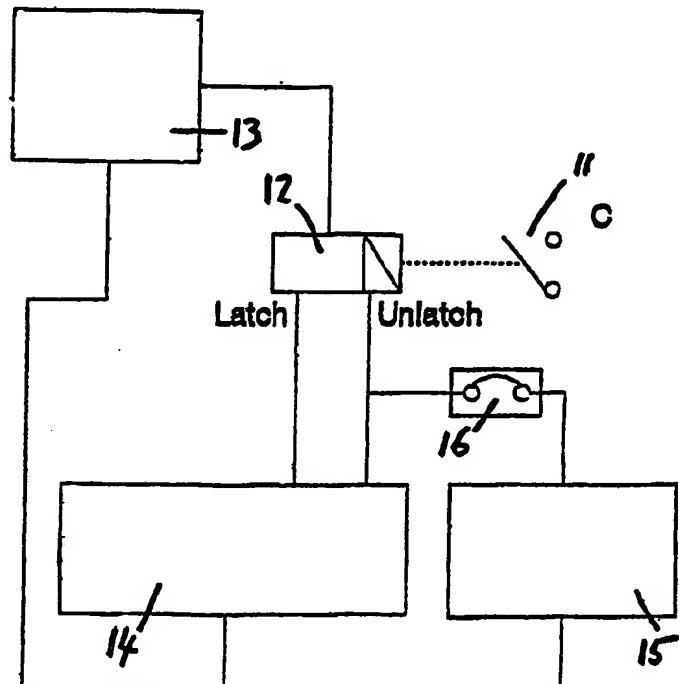
**(58) Field of Search**

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INT CL<sup>5</sup> H02H 3/24 3/247 3/253

## Online databases: WPI

**(54) Switch arrangement responsive to power supply failure**

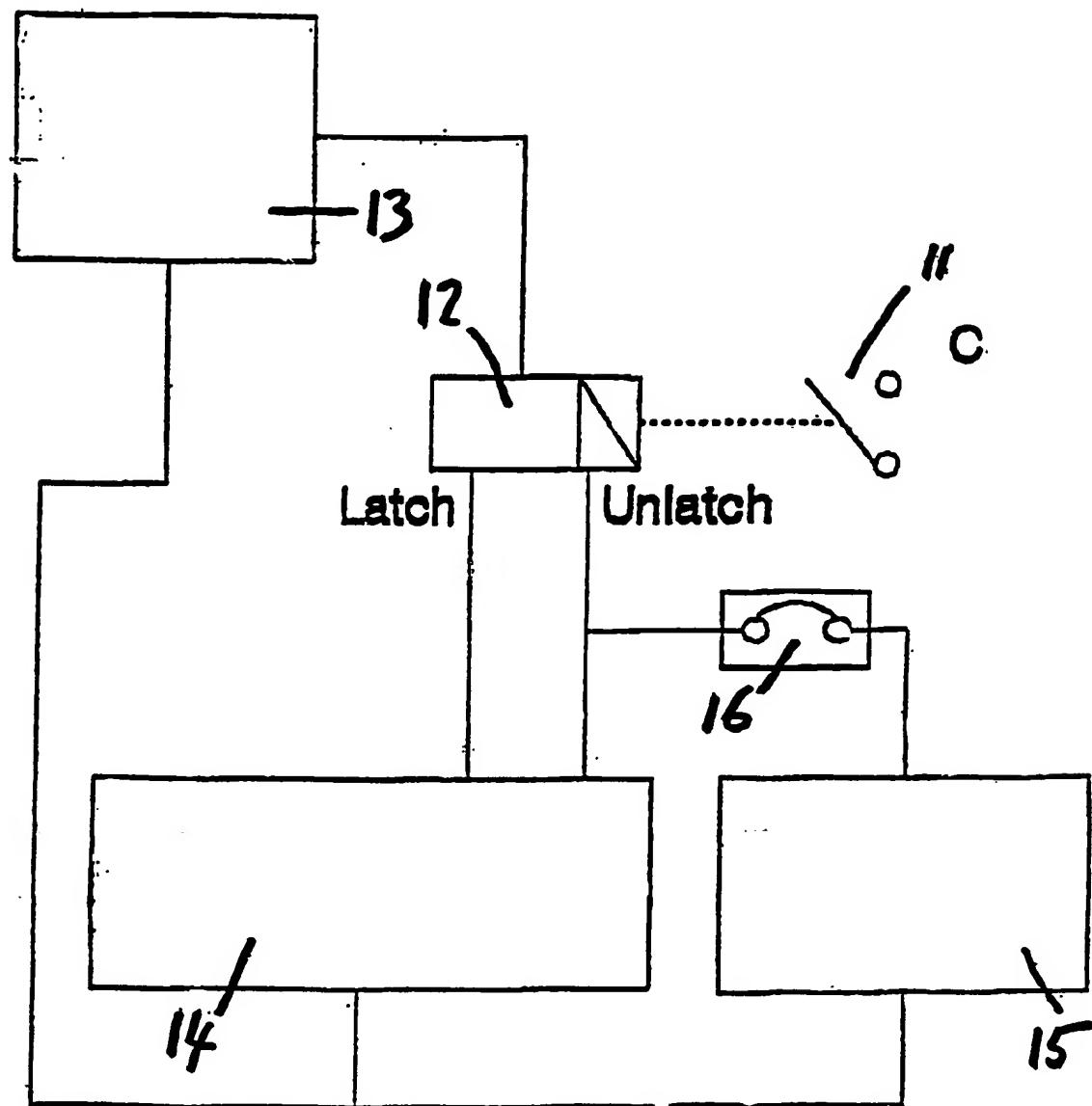
(57) A switch 11 provided with a detector 15 to sense a failure of power supply to the switch and a controller 14 operative to control switch opening in response to the detector. An undesirable current surge when the power supply is re-established is thus avoided. The detector 15 may respond to zero voltage or to a value below a minimum threshold, and an over-ride device 16 is provided. The switch may be a remotely controlled radio-teleswitch.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.  
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Switch Arrangement

The present invention relates to a switch arrangement. More particularly it relates to a remotely-controlled switching arrangement such as a radio-teleswitch and to a method of operating such an arrangement, especially upon failures of the electricity supply thereto.

10 Radio-teleswitches (e.g. for operating Economy-7 and similar systems) used by electricity supply authorities are conventionally constructed so that the switches controlled do not alter their state upon conditions of supply failure. However, this has the disadvantage that a current surge arises when the 15 supply is re-established; in fact, occasionally the current surge is so great that fuses are blown and it is actually impossible to reconnect the supply.

20 The present invention seeks to overcome the above problem.

According to a first aspect of the present invention there is provided a switch arrangement comprising a switch, means for opening and closing said switch, 25 means for sensing failure of the power supply to said switch, and means responsive to said sensing means to cause the switch to open.

30 The opening and closing means may be the unlatching and latching coils of a solenoid acting on said switch, and said responsive means may cause operation of said unlatching coil. The sensing means and preferably also the responsive means may act before the power is totally disconnected. However, the 35 switch does not need to be opened until after the power is disconnected. This is convenient for most

applications where the response time of the switch itself is relatively high; in certain cases, though, it is envisaged that switch disconnection may also be completed before power removal.

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Many switch arrangements incorporate a low-voltage power supply which can supply power for a limited period after failure of the main power supply; in such cases the responsive means and preferably also the sensing means may act after the main power supply is totally disconnected.

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The responsive means preferably comprises a charge storing circuit. A breakable link may be provided for disabling the sensing and/or responsive means.

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According to a second aspect of the present invention there is provided a method of disconnecting a switch, comprising sensing or predicting failure of the power supply to the switch, and in response thereto causing actuation of means to cause the switch to be opened. The switch may be opened before, during or (preferably) after removal of the power supply.

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A preferred embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawing, the sole Figure of which shows a radio teleswitch arrangement.

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The radio teleswitch arrangement 10 comprises output contact switches identified as A,B,C and D; only switch C is illustrated in the Figure. The A & B switches are rated at 2 amp, and are generally used for tariff control. The C & D switches are generally used for load control, with the C switch rated 25 amp, and D switch rated at 80 amp.

The contacts 11 of switch C are physically opened and closed via a latching solenoid 12.

5 The solenoid 12 is operated by energising either the latching coil to close the C contact or the unlatching coil to open the C contact. The energy required to operate the solenoid is provided by a charge storage circuit 13.

10 Under normal operation the C switch state is determined by switch state control circuitry 14 which latches or unlatches the solenoid 12 accordingly.

15 The teleswitch arrangement also comprises a supply failure detector 15 which senses or predicts the loss of supply and opens the C and/or D load switches. The detecting function may be performed by discrete circuitry within detector 15 and which monitors power supply voltages; alternatively it may be performed by 20 microprocessor software.

25 When supply failure occurs, e.g. due to a current surge a supply failure detector 15 enables a path for the residual charge stored in charge storage circuit 13 to energise the unlatch solenoid coil 12, hence opening the C Contact 11.

30 An option link 16 is also provided. When this link is closed the solenoid 12 unlatches when supply failure occurs. When the link is open the solenoid 12 does not unlatch when supply failure occurs. The link 16 may be pre-set as permanently closed during manufacture or when supplied. Alternatively it may 35 be set as desired by a customer to enable or disable the above-described arrangement.

The above arrangement has the advantage of avoiding current surges upon re-establishment of the power supply. Bearing in mind that it takes a typical teleswitch a random period of between 3 minutes and

5      4.1/2 minutes to respond to a switch-on instruction, individual loads of a plurality will switch on throughout this period and a current surge will be avoided.

10     Various modifications may be made to the above-described arrangement. There may be any desired combination of low current and load switches, even just a single load switch, and the supply failure detector may operate on a single one, more than one, 15    or all of them. If desired, the charge storage circuit may effect closure of one or more switches, e.g. in associated control or monitoring circuits.

20     The charge storing circuit 13 may be replaced by an electro-mechanical component in which electrical energy is converted to mechanical potential energy for release after power disconnection to open the switch. For example, a spring-biassed plunger acting 25    as a solenoid could be employed.

25     The supply failure detector 15 may detect zero power or alternatively may detect when the supplied power falls below a predetermined threshold. An advantage of this is that, even though indication or completion 30    of the actual opening of the switch may not be effected until after the power has failed, the instruction is issued while the power is still connected. In Economy-7 type systems, it is not essential that the load switches are permanently 35    "on", so that even if the supply failure detector incorrectly predicts an imminent power supply

failure, the supply will be reconnected within a few minutes.

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**CLAIMS**

1. A switch arrangement comprising a switch, means for opening and closing the switch, sensing means for sensing failure of power supply to said switch, and responsive means to the responsive sensing means sensing power supply failure to control the means for opening the switch to cause the switch to open.
2. A switch arrangement according to claim 1, in which the means for opening and closing the switch are unlatching and latching coils of a solenoid, and the responsive means controls operation of the unlatching coil.
3. A switch arrangement according to claim 1 or claim 2, in which the sensing means senses power supply failure upon the power supply level falling below a predetermined threshold.
4. A switch arrangement according to claim 3, in which the sensing means senses power supply failure and the responsive means operates to cause the switch to open before the power supply level reduces to zero.
5. A switch arrangement according to claim 4, in which the means for opening the switch operates after the power supply level reduces to zero.
6. A switch arrangement according to any preceding claim, in which power is provided by a main power supply and in the event of failure of the main power supply by a backup power supply.

7. A switch arrangement according to claim 6, in which the sensing means and responsive means operate in the event of failure of the main power supply.
8. A switch arrangement according to any preceding claim, in which the responsive means comprises a charge storage device.
9. A switch arrangement according to any preceding claim, further comprising a breakable connection for disabling the sensing means and/or responsive means.
10. A method of disconnecting a switch comprising sensing or predicting failure of power supply to the switch, and in response thereto causing actuation of means to cause the switch to be opened.
11. A switch arrangement as hereinbefore described, with reference to the drawing.
12. A method of disconnecting a switch as hereinbefore described, with reference to the drawing.

Relevant Technical Fields		Search Examiner D C BRUNT
(i) UK Cl (Ed.M)	H2K (KCX, KG, KJK)	
(ii) Int Cl (Ed.5)	H02H (3/24, 3/247, 3/253)	Date of completion of Search 2 DECEMBER 1994
<b>Databases (see below)</b> (i) UK Patent Office collections of GB, EP, WO and US patent specifications.		Documents considered relevant following a search in respect of Claims :- 1-12
(ii) ONLINE DATABASES: WPI		

## Categories of documents

X: Document indicating lack of novelty or of inventive step. P: Document published on or after the declared priority date but before the filing date of the present application.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category. E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

A: Document indicating technological background and/or state of the art. &: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2033177 A	(DORMAN SMITH) whole document	1-4,8,10
X	GB 2023952 A	(COAL INDUSTRY) see page 2 lines 20-32	1-4,8,10
X	GB 1517176	(WESTINGHOUSE) see page 4 lines 10-42	1,3,4,10
X	GB 1261995	(BENDIX) whole document	1,3,5,8,10
X	US 4905115	(WHIDDEN) see column 4 lines 10-29	1,3,4,9,10
X	US 4418374	(CALLAN) whole document	1-4,8,10
X	US 4412267	(HANSEN) see Figure 4	1,3,4,8,10
X	US 4331996	(MATSKO) see column 5 lines 42 - column 6 line 13	1,2,5,8,10
X	US 4183071	(RUSSELL) see column 4 lines 19-65 and column 5 lines 54-64	1,3,5,8,9 10

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).